In re Patent Application of:
MAO ET AL
Serial No. **10/611,784**
Filed: **JUNE 30, 2003**

REMARKS

Claims 1 to 16 are currently pending.

Claims 1,2,5-8 and 13-16 have been rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent No. 6,687,049 to Sulhoff et al.

Claims 1,2,5-8 and 13-16 have been rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent No. 6,697,187 to Seydnejad et al.

Claims 3,4 and 9-12 have been rejected under 35 U.S.C. 103(a) in view of United States Patent No. 6,687,049 Sulhoff et al.

Claims 3,4 and 9-12 have been rejected under 35 U.S.C. 103(a) in view of United States Patent No. 6,697,187 Seydnejad et al.

The claims of the application have been amended to overcome the objections of the Examiner and to better define the invention in light of the prior art. In particular, claims 1,7 and 16 have been amended to clearly define the position of the power monitor, which is at the output of the amplifier. Claims 3 and 4 have been amended to clarify the methods used to derive the relationship between pump levels and signal levels, as detailed in paragraph [32]. Claim 7 has been amended to more clearly define the relationship between the "total amplified

signal power" and the "first and second Raman pump power levels".

The present invention discloses a simplified Raman amplifier providing dynamic gain control and a method for providing dynamic gain control, which is not known in the prior art. The Raman amplifier of the present invention is able to provide dynamic gain control over a complete system range of channel loading using only an output optical power monitor in conjunction with stored values based on a characterization of the multiple pump amplifier which is not understood in the prior art.

As stated in paragraph [08],"The present invention has found that in multiple pump Raman amplifiers a nearly linear relationship exists between total amplified signal power and pump power for each of different wavelength pumps in order to maintain original gain levels for an optical link with a fully loaded channel configuration."

Accordingly, claim 1 defines "c) deriving linear functions from the set of pre-established values for each of the at least first and second pump wavelengths; e) detecting a total amplified signal power from the tapped portion of the amplified signal; and f) calculating the required first and second pump powers to maintain the characterized gain profile and gain level as a unique solution from the linear functions..."

This unique relationship for dynamic control based on a single measured value is also defined in claim 7. Specifically

claim 7 defines "an optical power monitor at the output of the amplifier for measuring optical power of the amplified signals which changes as a result of ~~for monitoring~~ changes in channel loading;" and "a pump controller for comparing the optical power of the amplified signal to a first and a second stored linear function, said linear functions correlating each of a first and second Raman pump power levels to total amplified signal power... in response to changes in channel loading.

The relationship between total amplified signal power and pump powers in a multiple pump Raman amplifier is not recognized in the prior art.

Claims 1,2, 5-8 and 13-16 are rejected under 35 USC 102(e) as anticipated by Sulhoff et al.

Primarily Sulhoff et al. disclose two stage monitoring of both input and output signal powers, providing a measure of average gain for the amplifier. This requires twice as much monitoring hardware and more complicated coordination of control information. A feed forward system is alternatively proposed measuring only a signal input power. A further embodiment discloses a single monitor feedback system to maintain a constant output power as the input power level veries, "if the number of channels amplified by the amplifier 18 remains constant." The gain equalization of such an amplifier is different from the dynamic gain control disclosed in the present invention, where changes in channel loading are present.

In discussing the feed-forward approach, pump power is calculated based on measured input power in a given function. "As an approximation, the required pump power will scale almost linearly with the input power that is being amplified for most erbium-doped and other rare-earth doped amplifier arrangements. In Raman gain stages, the fractional increase in the pump power that is required to compensate for a given rise in input power may be significantly less than the fractional increase in the input power." Thus, a relationship between input power and pump power in an EDFA is taught, however, this relationship is not advanced for Raman amplifiers. No discussion of a relationship between total amplified signal power and the pump powers of multiple wavelength pumps in Raman amplifiers is given.

In support of the 102(e) rejection, the Office Action refers to Fig. 7b of the Sulhoff et al. patent and its description in col. 11 lines 3-50. Fig. 7b illustrates an erbium-doped amplifier including input monitor 38 and output monitor 42 at either end of amplifying fiber 52. The passage cited discloses the pump power relationship between pumps P1 and P2, which avoids operating the pumps in low power regimes where mode partition noise is significant. Perhaps most relevant to the present invention is the passage lines 18-24,"In Fig. 8 and the other drawings, it is generally assumed that the pump power is being varied as a function of measured input power P_{IN} (e.g. using a feed-forward relationship or a hybrid pump power relationship). The same types of relationships may be used if only feedback control techniques are involved in controlling pump power and other optical signals (e.g. output signals) are

measured." "Feedback" as used by Sulhoff et al. relies on the tap measurements of monitors 38 and 42. See col 9 lines 13-14, "Control unit 44 may also process input and output power information to calculate a feedback pump contribution $P_{PUMP-FB}$ using equations 3-5." Measuring the total amplified signal power alone as in the present invention is not envisioned.

Applicant has demonstrated that steps c and f as defined in claim 1 cannot be found in the prior art. Accordingly, claim 1 it is argued is novel and allowable as originally filed.

Further, independent claim 7 as amended, defines "said linear functions correlating each of a first and second Raman pump power levels to total amplified signal power..." No such correlation is demonstrated in the prior art. Accordingly, claim 7 is novel and allowable as currently amended.

Likewise, independent claim 16 defines "an optical power monitor at the output of the amplifier for measuring optical power of the amplified signals which changes as a result of changes in channel loading;" and "a pump controller for comparing the optical power of the amplified signal to stored values correlating pump power levels of the first and second pump sources to total amplified signal power..." As discussed above, no correlation between amplified signal power and individual pump powers has been demonstrated in the prior art. Claim 16 as originally filed is novel and allowable.

Claims 1,2, 5-8 and 13-16 are also rejected under 35 USC 102(e) as anticipated by Seydnejad et al.

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Most significantly, Seydnejad does not disclose a dynamic system. Seydnejad et al. disclose a method for establishing uniform Raman gain "during the installation of an optical link." Seydnejad et al. have established a relationship between a total Raman pump power and an average Raman gain. Establishing average Raman gain, of course requires knowing an input power and an amplified output power. No optical power monitors are depicted in the figures as these are not part of the amplifier. The teaching of Seydnejad et al. cannot be said to anticipate the present invention, as it does not disclose dynamic gain control, nor any of the claimed steps or elements to achieve it.

Claims 3,4 and 9-12 are rejected as obvious under 35 USC 103(a) in view of Sulhhoff et al. Applicant submits that dependent claims 3,4 and 9-12 are not obvious as dependent on novel and non-obvious independent claims as detailed above.

Claims 3,4 and 9-12 are rejected as obvious under 35 USC 103(a) in view of Seydnejad et al. Applicant submits that dependent claims 3,4 and 9-12 are not obvious as dependent on novel and non-obvious independent claims as detailed above.

As such, it is respectfully submitted that all of the claims in the application are in condition for allowance. Early and favorable consideration would be appreciated.

Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

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Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees, to Deposit Account No. 50-1465 and please credit any excess fees to such deposit account.

Respectfully submitted,

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CERTIFICATE OF FACSIMILE TRANSMISSION

I HEREBY CERTIFY that the foregoing correspondence has been forwarded via facsimile number **703-872-9306** to the COMMISSIONER FOR PATENTS, this 23 day of May 2005.

J. Kallemeyer